



SEQUENCE LISTING

<110> Anderson, Annaliesa S.
Montgomery, Donna L.

<120> POLYPEPTIDES FOR INDUCING A PROTECTIVE
IMMUNE RESPONSE AGAINST STAPHYLOCOCCUS AUREUS

<130> 21490YP

<140> 10/589,381

<141> 2006-08-15

<150> PCT/US2005/004431

<151> 2005-02-14

<150> 60/545,447

<151> 2004-02-18

<160> 20

<170> FastSEQ for Windows Version 4.0

<210> 1

<211> 260

<212> PRT

<213> Artificial Sequence

<220>

<223> truncated derivative of sai-1

<400> 1

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|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Gly | Thr | Gln | Val | Ser | Gln | Ala | Thr | Ser | Gln | Pro | Ile | Asn | Phe | Gln | 1 | 5 | 10 | 15 |
| Val | Gln | Lys | Asp | Gly | Ser | Ser | Glu | Lys | Ser | His | Met | Asp | Asp | Tyr | Met | 20 | 25 | 30 | |
| Gln | His | Pro | Gly | Lys | Val | Ile | Lys | Gln | Asn | Asn | Lys | Tyr | Tyr | Phe | Gln | 35 | 40 | 45 | |
| Thr | Val | Leu | Asn | Asn | Ala | Ser | Phe | Trp | Lys | Glu | Tyr | Lys | Phe | Tyr | Asn | 50 | 55 | 60 | |
| Ala | Asn | Asn | Gln | Glu | Leu | Ala | Thr | Thr | Val | Val | Asn | Asp | Asn | Lys | Lys | 65 | 70 | 75 | 80 |
| Ala | Asp | Thr | Arg | Thr | Ile | Asn | Val | Ala | Val | Glu | Pro | Gly | Tyr | Lys | Ser | 85 | 90 | 95 | |
| Leu | Thr | Thr | Lys | Val | His | Ile | Val | Val | Pro | Gln | Ile | Asn | Tyr | Asn | His | 100 | 105 | 110 | |
| Arg | Tyr | Thr | Thr | His | Leu | Glu | Phe | Glu | Lys | Ala | Ile | Pro | Thr | Leu | Ala | 115 | 120 | 125 | |
| Asp | Ala | Ala | Lys | Pro | Asn | Asn | Val | Lys | Pro | Val | Gln | Pro | Lys | Pro | Ala | 130 | 135 | 140 | |
| Gln | Pro | Lys | Thr | Pro | Thr | Glu | Gln | Thr | Lys | Pro | Val | Gln | Pro | Lys | Val | 145 | 150 | 155 | 160 |
| Glu | Lys | Val | Lys | Pro | Thr | Val | Thr | Thr | Thr | Ser | Lys | Val | Glu | Asp | Asn | 165 | 170 | 175 | |
| His | Ser | Thr | Lys | Val | Val | Ser | Thr | Asp | Thr | Thr | Lys | Asp | Gln | Thr | Lys | 180 | 185 | 190 | |
| Thr | Gln | Thr | Ala | His | Thr | Val | Lys | Thr | Ala | Gln | Thr | Ala | Gln | Glu | Gln | 195 | 200 | 205 | |
| Asn | Lys | Val | Gln | Thr | Pro | Val | Lys | Asp | Val | Ala | Thr | Ala | Lys | Ser | Glu | 210 | 215 | 220 | |

Ser Asn Asn Gln Ala Val Ser Asp Asn Lys Ser Gln Gln Thr Asn Lys
 225 230 235 240
 Val Thr Lys His Asn Glu Thr Pro Lys Gln Ala Ser Lys Ala Lys Glu
 245 250 255
 Leu Pro Lys Thr
 260

<210> 2
 <211> 264
 <212> PRT
 <213> S. aureus

<220>

<400> 2
 Met Gly Thr Gln Val Ser Gln Ala Thr Ser Gln Pro Ile Asn Phe Gln
 1 5 10 15
 Val Gln Lys Asp Gly Ser Ser Glu Lys Ser His Met Asp Asp Tyr Met
 20 25 30
 Gln His Pro Gly Lys Val Ile Lys Gln Asn Asn Lys Tyr Tyr Phe Gln
 35 40 45
 Ala Val Leu Asn Asn Ala Ser Phe Trp Lys Glu Tyr Lys Phe Tyr Asn
 50 55 60
 Ala Asn Asn Gln Glu Leu Ala Thr Thr Val Val Asn Asp Asp Lys Lys
 65 70 75 80
 Ala Asp Thr Arg Thr Ile Asn Val Ala Val Glu Pro Gly Tyr Lys Ser
 85 90 95
 Leu Thr Thr Lys Val His Ile Val Val Pro Gln Ile Asn Tyr Asn His
 100 105 110
 Arg Tyr Thr Thr His Leu Glu Phe Glu Lys Ala Ile Pro Thr Leu Ala
 115 120 125
 Asp Ala Ala Lys Pro Asn Asn Val Lys Pro Val Gln Pro Lys Pro Ala
 130 135 140
 Gln Pro Lys Thr Pro Thr Glu Gln Thr Lys Pro Val Gln Pro Lys Val
 145 150 155 160
 Glu Lys Val Lys Pro Ala Val Thr Ala Pro Ser Lys Asn Glu Asn Arg
 165 170 175
 Gln Thr Thr Lys Val Val Ser Ser Glu Ala Thr Lys Asp Gln Ser Gln
 180 185 190
 Thr Gln Ser Ala Arg Thr Val Lys Thr Thr Gln Thr Ala Gln Asp Gln
 195 200 205
 Asn Lys Val Gln Thr Pro Val Lys Asp Val Ala Thr Ala Lys Ser Glu
 210 215 220
 Ser Asn Asn Gln Ala Val Ser Asp Asn Lys Ser Gln Gln Thr Asn Lys
 225 230 235 240
 Val Thr Lys Gln Asn Glu Val His Lys Gln Gly Pro Ser Lys Asp Ser
 245 250 255
 Lys Ala Lys Glu Leu Pro Lys Thr
 260

<210> 3
 <211> 280
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> amino His-tagged construct of SEQ ID NO: 1

<400> 3
 Met Gly Ser Ser His His His His His His Ser Ser Gly Leu Val Pro
 1 5 10 15

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Arg Gly Ser His Met Gly Thr Gln Val Ser Gln Ala Thr Ser Gln Pro
      20      25      30
Ile Asn Phe Gln Val Gln Lys Asp Gly Ser Ser Glu Lys Ser His Met
      35      40      45
Asp Asp Tyr Met Gln His Pro Gly Lys Val Ile Lys Gln Asn Asn Lys
      50      55      60
Tyr Tyr Phe Gln Thr Val Leu Asn Asn Ala Ser Phe Trp Lys Glu Tyr
      65      70      75      80
Lys Phe Tyr Asn Ala Asn Asn Gln Glu Leu Ala Thr Thr Val Val Asn
      85      90      95
Asp Asn Lys Lys Ala Asp Thr Arg Thr Ile Asn Val Ala Val Glu Pro
      100      105      110
Gly Tyr Lys Ser Leu Thr Thr Lys Val His Ile Val Val Pro Gln Ile
      115      120      125
Asn Tyr Asn His Arg Tyr Thr Thr His Leu Glu Phe Glu Lys Ala Ile
      130      135      140
Pro Thr Leu Ala Asp Ala Ala Lys Pro Asn Asn Val Lys Pro Val Gln
      145      150      155      160
Pro Lys Pro Ala Gln Pro Lys Thr Pro Thr Glu Gln Thr Lys Pro Val
      165      170      175
Gln Pro Lys Val Glu Lys Val Lys Pro Thr Val Thr Thr Thr Ser Lys
      180      185      190
Val Glu Asp Asn His Ser Thr Lys Val Val Ser Thr Asp Thr Thr Lys
      195      200      205
Asp Gln Thr Lys Thr Gln Thr Ala His Thr Val Lys Thr Ala Gln Thr
      210      215      220
Ala Gln Glu Gln Asn Lys Val Gln Thr Pro Val Lys Asp Val Ala Thr
      225      230      235      240
Ala Lys Ser Glu Ser Asn Asn Gln Ala Val Ser Asp Asn Lys Ser Gln
      245      250      255
Gln Thr Asn Lys Val Thr Lys His Asn Glu Thr Pro Lys Gln Ala Ser
      260      265      270
Lys Ala Lys Glu Leu Pro Lys Thr
      275      280

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<210> 4

<211> 284

<212> PRT

<213> Artificial Sequence

<220>

<223> amino His-tagged construct of SEQ ID NO: 2

<400> 4

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Met Gly Ser Ser His His His His His His Ser Ser Gly Leu Val Pro
  1      5      10      15
Arg Gly Ser His Met Gly Thr Gln Val Ser Gln Ala Thr Ser Gln Pro
      20      25      30
Ile Asn Phe Gln Val Gln Lys Asp Gly Ser Ser Glu Lys Ser His Met
      35      40      45
Asp Asp Tyr Met Gln His Pro Gly Lys Val Ile Lys Gln Asn Asn Lys
      50      55      60
Tyr Tyr Phe Gln Ala Val Leu Asn Asn Ala Ser Phe Trp Lys Glu Tyr
      65      70      75      80
Lys Phe Tyr Asn Ala Asn Asn Gln Glu Leu Ala Thr Thr Val Val Asn
      85      90      95
Asp Asp Lys Lys Ala Asp Thr Arg Thr Ile Asn Val Ala Val Glu Pro
      100      105      110
Gly Tyr Lys Ser Leu Thr Thr Lys Val His Ile Val Val Pro Gln Ile
      115      120      125

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Asn Tyr Asn His Arg Tyr Thr Thr His Leu Glu Phe Glu Lys Ala Ile
 130      135      140
Pro Thr Leu Ala Asp Ala Lys Pro Asn Asn Val Lys Pro Val Gln
145      150      155      160
Pro Lys Pro Ala Gln Pro Lys Thr Pro Thr Glu Gln Thr Lys Pro Val
      165      170      175
Gln Pro Lys Val Glu Lys Val Lys Pro Ala Val Thr Ala Pro Ser Lys
      180      185      190
Asn Glu Asn Arg Gln Thr Thr Lys Val Val Ser Ser Glu Ala Thr Lys
      195      200      205
Asp Gln Ser Gln Thr Gln Ser Ala Arg Thr Val Lys Thr Thr Gln Thr
      210      215      220
Ala Gln Asp Gln Asn Lys Val Gln Thr Pro Val Lys Asp Val Ala Thr
225      230      235      240
Ala Lys Ser Glu Ser Asn Asn Gln Ala Val Ser Asp Asn Lys Ser Gln
      245      250      255
Gln Thr Asn Lys Val Thr Lys Gln Asn Glu Val His Lys Gln Gly Pro
      260      265      270
Ser Lys Asp Ser Lys Ala Lys Glu Leu Pro Lys Thr
      275      280

```

<210> 5

<211> 268

<212> PRT

<213> Artificial Sequence

<220>

<223> carboxyl His-tagged construct of SEQ ID NO: 1

<400> 5

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Met Gly Thr Gln Val Ser Gln Ala Thr Ser Gln Pro Ile Asn Phe Gln
 1      5      10      15
Val Gln Lys Asp Gly Ser Ser Glu Lys Ser His Met Asp Asp Tyr Met
      20      25      30
Gln His Pro Gly Lys Val Ile Lys Gln Asn Asn Lys Tyr Tyr Phe Gln
      35      40      45
Thr Val Leu Asn Asn Ala Ser Phe Trp Lys Glu Tyr Lys Phe Tyr Asn
      50      55      60
Ala Asn Asn Gln Glu Leu Ala Thr Thr Val Val Asn Asp Asn Lys Lys
      65      70      75      80
Ala Asp Thr Arg Thr Ile Asn Val Ala Val Glu Pro Gly Tyr Lys Ser
      85      90      95
Leu Thr Thr Lys Val His Ile Val Val Pro Gln Ile Asn Tyr Asn His
      100      105      110
Arg Tyr Thr Thr His Leu Glu Phe Glu Lys Ala Ile Pro Thr Leu Ala
      115      120      125
Asp Ala Ala Lys Pro Asn Asn Val Lys Pro Val Gln Pro Lys Pro Ala
      130      135      140
Gln Pro Lys Thr Pro Thr Glu Gln Thr Lys Pro Val Gln Pro Lys Val
      145      150      155      160
Glu Lys Val Lys Pro Thr Val Thr Thr Thr Ser Lys Val Glu Asp Asn
      165      170      175
His Ser Thr Lys Val Val Ser Thr Asp Thr Thr Lys Asp Gln Thr Lys
      180      185      190
Thr Gln Thr Ala His Thr Val Lys Thr Ala Gln Thr Ala Gln Glu Gln
      195      200      205
Asn Lys Val Gln Thr Pro Val Lys Asp Val Ala Thr Ala Lys Ser Glu
      210      215      220
Ser Asn Asn Gln Ala Val Ser Asp Asn Lys Ser Gln Gln Thr Asn Lys
      225      230      235      240

```

Val Thr Lys His Asn Glu Thr Pro Lys Gln Ala Ser Lys Ala Lys Glu
245 250 255
Leu Pro Lys Thr Leu Glu His His His His His His
260 265

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<210> 6
<211> 395
<212> PRT
<213> Artificial Sequence
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<220>
<223> amino His-tagged construct of SEQ ID NO: 7

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| <400> | 6 | | | | | | | | | | | | | | |
| Met | His | His | His | His | His | His | Ser | Ser | Gly | Leu | Val | Pro | Arg | Gly | Ser |
| 1 | | | | 5 | | | | | 10 | | | | | 15 | |
| Gly | Met | Lys | Glu | Thr | Ala | Ala | Ala | Lys | Phe | Glu | Arg | Gln | His | Met | Asp |
| | | | 20 | | | | | 25 | | | | | 30 | | |
| Ser | Pro | Asp | Leu | Gly | Thr | Asp | Asp | Asp | Asp | Lys | Ala | Met | Gly | Thr | Lys |
| | | 35 | | | | | 40 | | | | | 45 | | | |
| His | Tyr | Leu | Asn | Ser | Lys | Tyr | Gln | Ser | Glu | Gln | Arg | Ser | Ser | Ala | Met |
| | 50 | | | | | 55 | | | | | 60 | | | | |
| Lys | Lys | Ile | Thr | Met | Gly | Thr | Ala | Ser | Ile | Ile | Leu | Gly | Ser | Leu | Val |
| 65 | | | | | 70 | | | | | 75 | | | | | 80 |
| Tyr | Ile | Gly | Ala | Asp | Ser | Gln | Gln | Val | Asn | Ala | Ala | Thr | Glu | Ala | Thr |
| | | | | 85 | | | | | 90 | | | | | 95 | |
| Asn | Ala | Thr | Asn | Asn | Gln | Ser | Thr | Gln | Val | Ser | Gln | Ala | Thr | Ser | Gln |
| | | | 100 | | | | | 105 | | | | | 110 | | |
| Pro | Ile | Asn | Phe | Gln | Val | Gln | Lys | Asp | Gly | Ser | Ser | Glu | Lys | Ser | His |
| | | 115 | | | | | 120 | | | | | 125 | | | |
| Met | Asp | Asp | Tyr | Met | Gln | His | Pro | Gly | Lys | Val | Ile | Lys | Gln | Asn | Asn |
| | 130 | | | | | 135 | | | | | 140 | | | | |
| Lys | Tyr | Tyr | Phe | Gln | Thr | Val | Leu | Asn | Asn | Ala | Ser | Phe | Trp | Lys | Glu |
| 145 | | | | | 150 | | | | | 155 | | | | | 160 |
| Tyr | Lys | Phe | Tyr | Asn | Ala | Asn | Asn | Gln | Glu | Leu | Ala | Thr | Thr | Val | Val |
| | | | | 165 | | | | | 170 | | | | | 175 | |
| Asn | Asp | Asn | Lys | Lys | Ala | Asp | Thr | Arg | Thr | Ile | Asn | Val | Ala | Val | Glu |
| | | | 180 | | | | | 185 | | | | | 190 | | |
| Pro | Gly | Tyr | Lys | Ser | Leu | Thr | Thr | Lys | Val | His | Ile | Val | Val | Pro | Gln |
| | | 195 | | | | | 200 | | | | | 205 | | | |
| Ile | Asn | Tyr | Asn | His | Arg | Tyr | Thr | Thr | His | Leu | Glu | Phe | Glu | Lys | Ala |
| | 210 | | | | | 215 | | | | | 220 | | | | |
| Ile | Pro | Thr | Leu | Ala | Asp | Ala | Ala | Lys | Pro | Asn | Asn | Val | Lys | Pro | Val |
| 225 | | | | | 230 | | | | | 235 | | | | | 240 |
| Gln | Pro | Lys | Pro | Ala | Gln | Pro | Lys | Thr | Pro | Thr | Glu | Gln | Thr | Lys | Pro |
| | | | | 245 | | | | | 250 | | | | | 255 | |
| Val | Gln | Pro | Lys | Val | Glu | Lys | Val | Lys | Pro | Thr | Val | Thr | Thr | Thr | Ser |
| | | | 260 | | | | | 265 | | | | | 270 | | |
| Lys | Val | Glu | Asp | Asn | His | Ser | Thr | Lys | Val | Val | Ser | Thr | Asp | Thr | Thr |
| | | 275 | | | | | 280 | | | | | 285 | | | |
| Lys | Asp | Gln | Thr | Lys | Thr | Gln | Thr | Ala | His | Thr | Val | Lys | Thr | Ala | Gln |
| | 290 | | | | | 295 | | | | | 300 | | | | |
| Thr | Ala | Gln | Glu | Gln | Asn | Lys | Val | Gln | Thr | Pro | Val | Lys | Asp | Val | Ala |
| 305 | | | | | 310 | | | | | 315 | | | | | 320 |
| Thr | Ala | Lys | Ser | Glu | Ser | Asn | Asn | Gln | Ala | Val | Ser | Asp | Asn | Lys | Ser |
| | | | | 325 | | | | | 330 | | | | | 335 | |
| Gln | Gln | Thr | Asn | Lys | Val | Thr | Lys | His | Asn | Glu | Thr | Pro | Lys | Gln | Ala |
| | | | | | | | | | | | | | | | |

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Phe | Ile | Ser | Thr | Val | Ala | Phe | Ala | Thr | Leu | Ala | Leu | Leu | Gly | Ser | Leu |
| 370 | | | | | | 375 | | | | | 380 | | | | |
| Ser | Leu | Leu | Leu | Phe | Lys | Arg | Lys | Glu | Ser | Lys | | | | | |
| 385 | | | | | 390 | | | | | 395 | | | | | |

<210> 7
 <211> 350
 <212> PRT
 <213> S. aureus

<400> 7

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Met | Thr | Lys | His | Tyr | Leu | Asn | Ser | Lys | Tyr | Gln | Ser | Glu | Gln | Arg | Ser |
| 1 | | | | 5 | | | | | 10 | | | | | 15 | |
| Ser | Ala | Met | Lys | Lys | Ile | Thr | Met | Gly | Thr | Ala | Ser | Ile | Ile | Leu | Gly |
| | | 20 | | | | | | 25 | | | | | 30 | | |
| Ser | Leu | Val | Tyr | Ile | Gly | Ala | Asp | Ser | Gln | Gln | Val | Asn | Ala | Ala | Thr |
| | | 35 | | | | | 40 | | | | | 45 | | | |
| Glu | Ala | Thr | Asn | Ala | Thr | Asn | Asn | Gln | Ser | Thr | Gln | Val | Ser | Gln | Ala |
| | | 50 | | | | 55 | | | | | 60 | | | | |
| Thr | Ser | Gln | Pro | Ile | Asn | Phe | Gln | Val | Gln | Lys | Asp | Gly | Ser | Ser | Glu |
| 65 | | | | 70 | | | | | 75 | | | | | | 80 |
| Lys | Ser | His | Met | Asp | Tyr | Met | Gln | His | Pro | Gly | Lys | Val | Ile | Lys | |
| | | | 85 | | | | | 90 | | | | | 95 | | |
| Gln | Asn | Asn | Lys | Tyr | Tyr | Phe | Gln | Thr | Val | Leu | Asn | Asn | Ala | Ser | Phe |
| | | | 100 | | | | | 105 | | | | | 110 | | |
| Trp | Lys | Glu | Tyr | Lys | Phe | Tyr | Asn | Ala | Asn | Asn | Gln | Glu | Leu | Ala | Thr |
| | | 115 | | | | | 120 | | | | | 125 | | | |
| Thr | Val | Val | Asn | Asp | Asn | Lys | Lys | Ala | Asp | Thr | Arg | Thr | Ile | Asn | Val |
| | | 130 | | | | 135 | | | | | 140 | | | | |
| Ala | Val | Glu | Pro | Gly | Tyr | Lys | Ser | Leu | Thr | Thr | Lys | Val | His | Ile | Val |
| 145 | | | | 150 | | | | | 155 | | | | | | 160 |
| Val | Pro | Gln | Ile | Asn | Tyr | Asn | His | Arg | Tyr | Thr | Thr | His | Leu | Glu | Phe |
| | | | 165 | | | | | 170 | | | | | 175 | | |
| Glu | Lys | Ala | Ile | Pro | Thr | Leu | Ala | Asp | Ala | Ala | Lys | Pro | Asn | Asn | Val |
| | | 180 | | | | | | 185 | | | | | 190 | | |
| Lys | Pro | Val | Gln | Pro | Lys | Pro | Ala | Gln | Pro | Lys | Thr | Pro | Thr | Glu | Gln |
| | | 195 | | | | | 200 | | | | | 205 | | | |
| Thr | Lys | Pro | Val | Gln | Pro | Lys | Val | Glu | Lys | Val | Lys | Pro | Thr | Val | Thr |
| | | 210 | | | | 215 | | | | | 220 | | | | |
| Thr | Thr | Ser | Lys | Val | Glu | Asp | Asn | His | Ser | Thr | Lys | Val | Val | Ser | Thr |
| 225 | | | | 230 | | | | | 235 | | | | | | 240 |
| Asp | Thr | Thr | Lys | Asp | Gln | Thr | Lys | Thr | Gln | Thr | Ala | His | Thr | Val | Lys |
| | | | 245 | | | | | | 250 | | | | | 255 | |
| Thr | Ala | Gln | Thr | Ala | Gln | Glu | Gln | Asn | Lys | Val | Gln | Thr | Pro | Val | Lys |
| | | 260 | | | | | | 265 | | | | | 270 | | |
| Asp | Val | Ala | Thr | Ala | Lys | Ser | Glu | Ser | Asn | Asn | Gln | Ala | Val | Ser | Asp |
| | | 275 | | | | | 280 | | | | 285 | | | | |
| Asn | Lys | Ser | Gln | Gln | Thr | Asn | Lys | Val | Thr | Lys | His | Asn | Glu | Thr | Pro |
| | | 290 | | | | 295 | | | | | 300 | | | | |
| Lys | Gln | Ala | Ser | Lys | Ala | Lys | Glu | Leu | Pro | Lys | Thr | Gly | Leu | Thr | Ser |
| 305 | | | | 310 | | | | | | 315 | | | | | 320 |
| Val | Asp | Asn | Phe | Ile | Ser | Thr | Val | Ala | Phe | Ala | Thr | Leu | Ala | Leu | Leu |
| | | | 325 | | | | | | 330 | | | | | 335 | |
| Gly | Ser | Leu | Ser | Leu | Leu | Leu | Phe | Lys | Arg | Lys | Glu | Ser | Lys | | |
| | | 340 | | | | | | 345 | | | | | 350 | | |

<210> 8
 <211> 354
 <212> PRT
 <213> S. aureus

<400> 8

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Met Thr Lys His Tyr Leu Asn Ser Lys Tyr Gln Ser Glu Gln Arg Ser
 1      5      10      15
Ser Ala Met Lys Lys Ile Thr Met Gly Thr Ala Ser Ile Ile Leu Gly
 20      25      30
Ser Leu Val Tyr Ile Gly Ala Asp Ser Gln Gln Val Asn Ala Ala Thr
 35      40      45
Glu Ala Thr Asn Ala Thr Asn Asn Gln Ser Thr Gln Val Ser Gln Ala
 50      55      60
Thr Ser Gln Pro Ile Asn Phe Gln Val Gln Lys Asp Gly Ser Ser Glu
 65      70      75
Lys Ser His Met Asp Tyr Met Gln His Pro Gly Lys Val Ile Lys
 85      90      95
Gln Asn Asn Lys Tyr Tyr Phe Gln Ala Val Leu Asn Asn Ala Ser Phe
100      105      110
Trp Lys Glu Tyr Lys Phe Tyr Asn Ala Asn Asn Gln Glu Leu Ala Thr
115      120      125
Thr Val Val Asn Asp Asp Lys Lys Ala Asp Thr Arg Thr Ile Asn Val
130      135      140
Ala Val Glu Pro Gly Tyr Lys Ser Leu Thr Thr Lys Val His Ile Val
145      150      155
Val Pro Gln Ile Asn Tyr Asn His Arg Tyr Thr Thr His Leu Glu Phe
165      170      175
Glu Lys Ala Ile Pro Thr Leu Ala Asp Ala Ala Lys Pro Asn Asn Val
180      185      190
Lys Pro Val Gln Pro Lys Pro Ala Gln Pro Lys Thr Pro Thr Glu Gln
195      200      205
Thr Lys Pro Val Gln Pro Lys Val Glu Lys Val Lys Pro Ala Val Thr
210      215      220
Ala Pro Ser Lys Asn Glu Asn Arg Gln Thr Thr Lys Val Val Ser Ser
225      230      235
Glu Ala Thr Lys Asp Gln Ser Gln Thr Gln Ser Ala Arg Thr Val Lys
245      250      255
Thr Thr Gln Thr Ala Gln Asp Gln Asn Lys Val Gln Thr Pro Val Lys
260      265      270
Asp Val Ala Thr Ala Lys Ser Glu Ser Asn Asn Gln Ala Val Ser Asp
275      280      285
Asn Lys Ser Gln Gln Thr Asn Lys Val Thr Lys Gln Asn Glu Val His
290      295      300
Lys Gln Gly Pro Ser Lys Asp Ser Lys Ala Lys Glu Leu Pro Lys Thr
305      310      315
Gly Leu Thr Ser Val Asp Asn Phe Ile Ser Thr Val Ala Phe Ala Thr
325      330      335
Leu Ala Leu Leu Gly Ser Leu Ser Leu Leu Leu Phe Lys Arg Lys Glu
340      345      350
Ser Lys

```

<210> 9

<211> 358

<212> PRT

<213> Artificial Sequence

<220>

<223> carboxyl His-tagged construct of SEQ ID NO: 7

<400> 9

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Met Thr Lys His Tyr Leu Asn Ser Lys Tyr Gln Ser Glu Gln Arg Ser
 1      5      10      15
Ser Ala Met Lys Lys Ile Thr Met Gly Thr Ala Ser Ile Ile Leu Gly
 20      25      30

```

```

Ser Leu Val Tyr Ile Gly Ala Asp Ser Gln Gln Val Asn Ala Ala Thr
   35           40           45
Glu Ala Thr Asn Ala Thr Asn Asn Gln Ser Thr Gln Val Ser Gln Ala
   50           55           60
Thr Ser Gln Pro Ile Asn Phe Gln Val Gln Lys Asp Gly Ser Ser Glu
   65           70           75           80
Lys Ser His Met Asp Asp Tyr Met Gln His Pro Gly Lys Val Ile Lys
           85           90           95
Gln Asn Asn Lys Tyr Tyr Phe Gln Thr Val Leu Asn Asn Ala Ser Phe
   100          105          110
Trp Lys Glu Tyr Lys Phe Tyr Asn Ala Asn Asn Gln Glu Leu Ala Thr
   115          120          125
Thr Val Val Asn Asp Asn Lys Lys Ala Asp Thr Arg Thr Ile Asn Val
   130          135          140
Ala Val Glu Pro Gly Tyr Lys Ser Leu Thr Thr Lys Val His Ile Val
   145          150          155          160
Val Pro Gln Ile Asn Tyr Asn His Arg Tyr Thr Thr His Leu Glu Phe
           165          170          175
Glu Lys Ala Ile Pro Thr Leu Ala Asp Ala Ala Lys Pro Asn Asn Val
           180          185          190
Lys Pro Val Gln Pro Lys Pro Ala Gln Pro Lys Thr Pro Thr Glu Gln
           195          200          205
Thr Lys Pro Val Gln Pro Lys Val Glu Lys Val Lys Pro Thr Val Thr
   210          215          220
Thr Thr Ser Lys Val Glu Asp Asn His Ser Thr Lys Val Val Ser Thr
   225          230          235          240
Asp Thr Thr Lys Asp Gln Thr Lys Thr Gln Thr Ala His Thr Val Lys
           245          250          255
Thr Ala Gln Thr Ala Gln Glu Gln Asn Lys Val Gln Thr Pro Val Lys
           260          265          270
Asp Val Ala Thr Ala Lys Ser Glu Ser Asn Asn Gln Ala Val Ser Asp
           275          280          285
Asn Lys Ser Gln Gln Thr Asn Lys Val Thr Lys His Asn Glu Thr Pro
   290          295          300
Lys Gln Ala Ser Lys Ala Lys Glu Leu Pro Lys Thr Gly Leu Thr Ser
   305          310          315          320
Val Asp Asn Phe Ile Ser Thr Val Ala Phe Ala Thr Leu Ala Leu Leu
           325          330          335
Gly Ser Leu Ser Leu Leu Leu Phe Lys Arg Lys Glu Ser Lys Leu Glu
           340          345          350
His His His His His
   355

```

<210> 10

<211> 843

<212> DNA

<213> Artificial Sequence

<220>

<223> nucleic acid sequence encoding SEQ ID NO: 3

<400> 10

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atgggcagca gccatcatca tcatcatcac agcagcggcc tgggtgccgcg cggcagccat 60
atgggcacac aagtttctca agcaacatca caaccaatta atttccaagt gcaaaaagat 120
ggctcttcag agaagtcaca catggatgac tatatgcaac accctggtaa agtaattaaa 180
caaaataata aatattatgt ccaaaccgtg ttaaacaatg catcattctg gaaagaatac 240
aaattttaca atgcaaacaa tcaagaatta gcaacaactg ttgttaacga taataaaaaa 300
gcggatacta gaacaatcaa tggtgcagtt gaacctggat ataagagctt aactactaaa 360
gtacatatgt tcgtgccaca aattaattac aatcatagat atactacgca tttggaattt 420
gaaaaagcaa ttcctacatt agctgacgca gcaaaaccaa acaatgttaa accggttcaa 480
ccaaaaccag ctcaacctaa aacacctact gagcaaacta aaccagttca acctaaagtt 540

```



```

gaaaaagtta aacctactgt aactacaaca agcaaagttg aagacaatca ctctactaaa 600
gttgtaagta ctgacacaac aaaagatcaa actaaaacac aaactgctca tacagttaaa 660
acagcacaaa ctgctcaaga acaaaaataaa gttcaaacac ctgttaaaga tgttgcaaca 720
gcgaaatctg aaagcaacaa tcaagctgta agtgataata aatcacaaca aactaacaaa 780
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tga 843

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<210> 11

<211> 855

<212> DNA

<213> Artificial Sequence

<220>

<223> nucleic acid sequence encoding SEQ ID NO: 4

<400> 11

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ggctcttcag agaagtcaca catggatgac tatatgcaac accctggtaa agtgattaaa 180
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ccaaaacctg ctcaacctaa aacacctact gagcaaacga aaccagttca acctaaagtt 540
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acaacacaaa cagctcaaga tcaaaaataaa gttcaaacac ctgttaaaga tgttgcaaca 720
gcgaaatctg aaagcaacaa tcaagctgta agtgacaata aatcacaaca aactaacaaa 780
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<211> 37

<212> DNA

<213> Artificial Sequence

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<223> primer

<400> 12

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<210> 13

<211> 36

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<213> Artificial Sequence

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<223> primer

<400> 13

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<210> 14

<211> 37

<212> DNA

<213> Artificial Sequence

<220>

<223> primer

<400> 14
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21490YP

<212> PRT

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<223> LPXTG Motif

<220>

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<222> (3)...(3)

<223> Xaa = any amino acid

<400> 20

Leu Pro Xaa Thr Gly

1

5